Small Business Innovation Research/Small Business Tech Transfer

Low-Gravity Mimicking Simulants and Evaluation of Simulant Flow, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

This project will provide a new method for testing flow/no-flow conditions and other gravity-driven flow behavior of Lunar or planetary regolith under reduced gravity, through the use of surrogate regolith simulants which mimic the effects of reduced gravity. New calibration data for numerical flow simulation models will also be obtained. The new low-g simulants will provide readily accessible, inexpensive means to verify that equipment intended to function under reduced gravity conditions, will actually function as intended when deployed in the 'real' application environment. Drop towers or parabolic flights are the only current viable methods available to create reduced gravity environments for testing equipment, without involving actual flights in space; but they have severe restrictions on test duration, volume and expense. Recent simulations, drop tower tests, and centrifuge tests have demonstrated that granular materials tend to act more 'cohesive' at reduced gravity. This change in behavior at reduced gravity, is not due to a change in cohesive strength of the material, rather it is due to a reduction in the gravity driving force inducing material to flow. Under reduced gravity, reduced flow rates and/or flow stoppages are observed in hoppers; and, in rotating drum flows large clumps and large avalanches develop, which are not seen for the same material at one-g. The large fine-fraction, and potentially increased surface energies, of in-situ regolith material already increase the likelihood of flow stoppages, or no-flow conditions, occurring within in-situ resource utilization processing equipment. The additional risk of flow stoppages because of reduced gravity is difficult to test terrestrially. The low-gravity-emulating surrogate regolith simulants developed and verified under this research, and the calibrated numerical simulation models, will offer new, inexpensive, methods to test whether solids will flow or not under reduced gravity.

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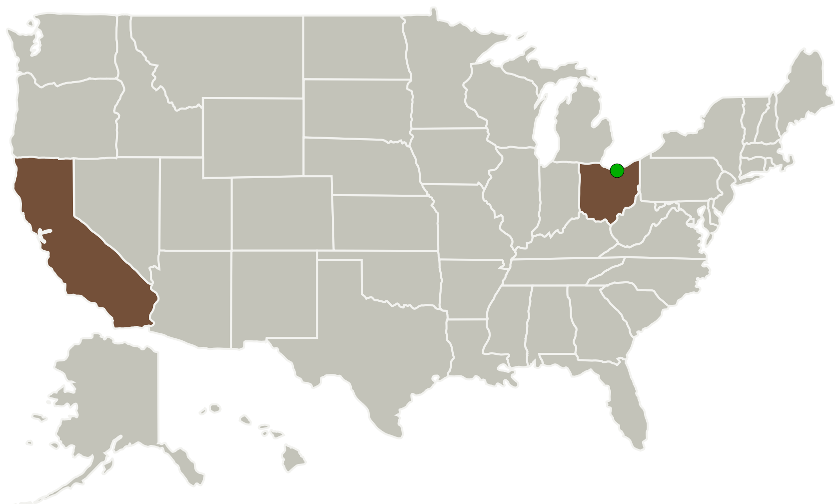
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Grainflow Dynamics, Inc.	Lead Organization	Industry	Livermore, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/139187)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Grainflow Dynamics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

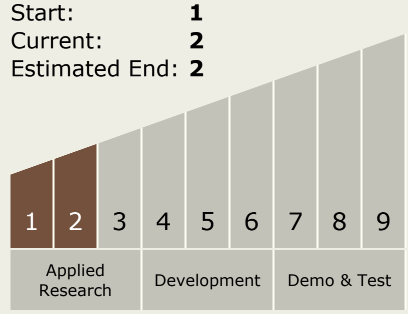
Carlos Torrez

Principal Investigator:

Otis R Walton

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - └─ TX07.1 In-Situ Resource Utilization
    - └─ TX07.1.2 Resource Acquisition, Isolation, and Preparation

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System